

**DRAFT  
TECHNICAL REVIEW**

**DRAFT REMEDIAL DESIGN REPORT  
GROUNDWATER EXTRACTION SYSTEM**

**SIMPLOT PLANT AREA  
EASTERN MICHAUD FLATS SUPERFUND SITE**

**October 3, 2002**

**GENERAL COMMENT**

1. The Draft Remedial Design Report for the Groundwater Extraction System for the Simplot Plant Area (Draft RDR/GES) has been reviewed for technical adequacy. The preliminary extraction system design and supporting analysis presented in the Draft RDR/GES provides good basis for initiating discussions regarding the design of an extraction system intended to meet the performance standards established in the July 23, 2001 Consent Decree. However, review of the report has identified a number of concerns regarding the underlying conceptual design of the system, the analysis used to support the system design, and a number of specific design details. These concerns are identified in the following specific comments.

**SPECIFIC COMMENTS**

**2.0 SUMMARY OF FACTORS AFFECTING REMEDIAL DESIGN**

**2.5 Modeling in Support of Extraction System Design**

1. The Draft RDR/GES (pg. 13) indicates that a Visual MODFLOW model of the flow system, constructed using data collected during and subsequent to the RI, was used during the FS to evaluate the effectiveness of various well configurations for capture of affected groundwater. A study using this model indicated that nearly all of the affected groundwater that is not captured by the facility production wells could be intercepted by placing wells in three locations identified on Figure 20 of the Draft RDR/GES. Although additional modeling has been performed to assist in the placement of pumping wells in these general locations and in estimating the pumping rates from these wells, the original RI modeling study appears to provide the underlying basis for the currently proposed extraction system.

Appendix B of the Draft RDR/GES presents additional discussion regarding the groundwater modeling conducted in support of the extraction system design. Appendix B (pg. B-3) states that "the FS modeling effort provided a preliminary estimate of how

the flow system could respond to the stress of a groundwater extraction.” However, Appendix B (pg. B-2) indicated that one limitation of the RI model, on which the FS model was based, was that “abrupt changes in hydraulic conductivity values (up to five orders in magnitude in some cases) were assigned to adjacent zones in each layer and likely had a significant effect on the calculated flow directions.” When discussing the FS modeling, Appendix B (pg. B-3) further acknowledged that “the characterization of hydraulic conductivities within the model caused some of the flow to be ‘channeled’ toward extraction wells in a manner that may not occur in the actual system.” Appendix B also acknowledged that hydraulic conductivities in certain area of the model have proven to be incorrect. Additional field investigation were conducted to help address some of the potential problems with the FS model.

Details regarding the FS modeling are not readily available. Consequently, it is difficult to ascertain how the potential inaccuracies in the model may have influenced the conclusions reached regarding groundwater flow paths and potential capture zones created by potential extraction wells. However, this model appears to provide much of the basis for establishing flow paths in and around the bedrock ridge identified on site (see Specific Comment No. 2). In addition, the model appears to provide the basis for conclusions regarding the capture of impacted groundwater in the lower zone by the facility production wells. It is not clear that the model provides a reliable tool for assessing flow in the lower zone. It is also not clear that production well pumping rates similar to those anticipated during the planned extraction system operation were used in the FS modeling efforts. Additional assurance appear necessary to demonstrate that the RI and FS modeling is sufficiently reliable for the purposes for which it is used in the design of the proposed extraction system.

### **2.5.1 Identification of Candidate Extraction Areas**

2. Boring data has identified a buried bedrock ridge or knob that appears to influence groundwater flow and contaminant migration at the Simplot facility. The bedrock ridge is shown the Elevation Contour Map of the Bedrock Surface provided as Figure 6 of the Draft RDR/GES. The proposed extraction system design does not include any extraction wells immediately downgradient from this ridge. When justifying this design, the Draft RDR/GES (pg. 13) states that:

“Extraction wells were not considered to be practical any area downgradient of the bedrock knob for the following reasons: 1) the groundwater flow rates out of the central area occupied by the bedrock knob and the observed concentrations of arsenic and other gypsum stack related constituents downgradient of the knob are much lower than the adjacent areas, particularly to east of the knob, 2) extraction wells in this area are likely to be much less effective than wells located to intercept groundwater along the major flow paths to east and west of the bedrock knob and 3) data indicate that the Simplot production wells capture a significant portion of the affecting groundwater flow and Northward from the bedrock knob.”

However, the Upper Zone Arsenic Isoconcentration Maps provided in Figure 9 of the Draft RDR/GES indicated that arsenic concentrations are elevated significantly in the upper aquifer at monitoring well location MW-334 (.587 ug/l in 2001). The Upper Zone Potentiometric Surface and Groundwater Flow Direction Maps provided as Figure 7 of the Draft RDR/GES show that MW-334 is directly down gradient from the end of the bedrock ridge. Inspection of the well log for Boring 334 provide in Appendix B of the RI indicate at least ten feet of saturated gravels (primarily sandy gravels) are present in the upper zone at this location. Moreover, the groundwater flow contours show no impact from the facility's production well in this area of the upper zone, although MW-334 is located in close proximity to SWP-4. In addition, the groundwater flow contours appear to indicate that contaminants in MW-334 are flowing with groundwater directly from groundwater ridge and not from the east or west of the bedrock ridge.

These observation do not appear to support the justifications provided in the Draft RDR/GES for not locating extraction wells downgradient from the bedrock ridge. While locating extraction wells within the bedrock maybe problematic due to low yield of the bedrock, there appears to be highly permeable deposits immediately downgradient from the ridge. These data also appear to indicate that while some of the contaminants infiltrating into bedrock may discharge into the deeper zone, a significant amount of groundwater influenced by the gypsum stack appears to be discharging from the bedrock ridge directly into the shallow zone and is not captured by the facility's production wells. The arsenic concentrations depicted on Figure 9 also indicate that the arsenic level downgradient of the ridge in MW-334 is actually higher than in the wells located to the east of the ridge along the front of the lower gypsum stack. Thus, it appears that the extractions system should be expanded to control the groundwater discharging into the upper aquifer from the bedrock ridge.

### **2.5.2 Recommended Extraction Well Configuration and Pumping Rates**

3. The Draft RDR/GES (pg. 14) states that "further details of the final modeling and capture zone analysis performed to support extraction system design are presented in Appendix B." However, as noted in Specific Comment No. 9, the model provided in Appendix B to support the preliminary design does not appear adequate to support final design. Moreover, concerns regarding the reliability of modeling conducted for the RI and FS for the purposes of final extraction system design have been identified (see Comment No. 1). Consequently, it does not appear appropriate to refer to the modeling present in Appendix B as the final modeling to support extractions system design.

## **3.0 REMEDIAL DESIGN**

### **3.1 West Plant Area Extraction Wells**

4. The Draft RDR/GES (pg. 17) indicates that existing well 346 will not be used for extraction "because is screened in an underlying saturated zone which is relatively free of affected groundwater and would not provide effective capture of arsenic mass." Instead, a new extraction well will be located in the vicinity of well 308. While the exact

configuration of the relict channel on the western side of the facility is not known, bedrock surface contours shown on Figure 6 of the Draft RDR/GES indicates that well 308 is located on the FMC side of the apparent axis of the relict channel. If this is in fact the case, the location may not be a good location for an extraction well because it may tend to collect groundwater migrating to the east from the FMC property rather than groundwater migrating to the west from beneath the gypsum stack. Particular attention should be focused on locating extraction wells on the west side of the axis. A geophysical survey may be useful for locating the axis of the relict channel.

### **3.2 East Plant Area Extraction Wells**

5. The Draft RDR/GES indicates that “based on modeling and pilot testing results, the upper zone wells will be approximately 80 feet deep and spaced approximately 80 feet apart.” While the spacing of 80 feet may be only a preliminary estimate, there does not appear to be incorporated into the RDR/GES any procedure to adjust spacing according to the conditions actually encountered during individual well installation. To help ensure that the extraction well system meets the performance standard of hydraulic containment of groundwater impacted by the gypsum stack, it is recommended that testing of each well be conducted as it is installed to ensure that the hydraulic conditions encountered are as anticipated in the original design. If the anticipated conditions are not encountered, some means of modifying the well spacing as necessary should be incorporated into the well installation plan.
6. The planned locations of the extraction wells installed in the shallow zone in the East Plant Area are shown in Figure 21. Although other well locations are not shown, Figure 21 appears to indicate that the line of extraction wells placed at the toe of the lower gypsum stack will extend to the east only until the approximate location of MW-332. However, groundwater flow maps shown in Figure 7 and arsenic isoconcentration maps shown in Figure 9 appear to indicate that groundwater in the upper zone clearly impacted by the lower gypsum stack is migrating from beneath the gypsum stacks to the east of MW-332 and would not be controlled hydraulically by the proposed system. Similarly, examination of the groundwater flow directions and arsenic concentrations in the lower zone appear to indicate that any impacted groundwater discharging to the lower zone in the area east of MW-332 would not likely be captured by the proposed extraction system. Unless adequate justification can be provided for not doing so, the extraction well coverage should be expanded further to the east to clearly control all groundwater potentially impacted by the gypsum stack.

## **4.0 IMPLEMENTATION CONSIDERATIONS**

### **4.2 System Start-up and Optimization**

7. When discussing system start-up and optimization, the Draft RDR/GES (pg. 23) states that:

“The performance of the individual pumping wells will be evaluated as the wells are

brought online. Field data will be collected to assess well performance and to evaluate the radius of influence and well capture. These data may include extraction flow rate, pumping well drawdown, drawdown in nearby observation wells, and extracted water quality. Limited groundwater modeling may also be used to evaluate pumping well performance. Based on these findings, individual well pumping rates will be adjusted to optimize overall capture of stack affected groundwater."

There are no further details regarding the monitoring and evaluation program that will be used to demonstrate that the groundwater extraction system meets the performance standard established in the Section III.D.4.b of the July 23, 2001 Consent Decree. Presumably, further details of such a program will be provided in the Groundwater Extraction RAWP (see Comment No. 8).

While it may not be reasonable to expect the full details of monitoring and evaluation program that will be used to demonstrate the hydraulic effectiveness of the extraction system in the Draft RDR/GES, evaluation of the currently proposed extraction system raises some concern over how the hydraulic effectiveness of such a system will be demonstrated within the 18 month start-up period currently anticipated. Normally, the hydraulic effectiveness of a groundwater extraction system is demonstrated using water level and groundwater quality measurements from nearby wells. However, it's not clear that a sufficient number of wells are located within close proximity of all of the proposed extraction wells to demonstrate the hydraulic effectiveness of the extraction system using water level data. Similarly, it's not clear that sufficient wells are located immediately downgradient from the extraction wells to demonstrate system effectiveness through changes in groundwater quality within the start-up period. There appears to be no plans to install additional monitoring wells that might provide the necessary hydraulic or groundwater quality data. While numerical or analytical modeling maybe helpful for demonstrating hydraulic containment of groundwater impacted by the gypsum stack, a description of such potential modeling has not been provided. Because of the potential difficulties in demonstrating the efficacy of the proposed extraction system, further assurances should be provided that sufficient data will be available to demonstrate the efficacy of the system.

## **6.0 FINAL DESIGN AND OTHER WORK REQUIRED**

### **6.4 Additional Plans Required**

#### **6.4.3 Remedial Action**

8. The Draft RDR/GES (pg. 29) indicates that "as appropriate, the RAWP may include a System Start-Up and Optimization Plan describing the procedures that will be used to evaluate and optimize groundwater capture during the initial start-up period." However, when discussing system start-up and optimization, the Draft RDR/GES (pg. 23) states that "further details regarding extraction system optimization will be included as part of the Groundwater Extraction Remedial Action Work Plan." Moreover, the Prefinal Remedial Design Report/Groundwater Monitoring (Prefinal RDR/GM)(pg. 3) states that

“field parameters such as extraction rates, pumping and observation well draw downs and possibly groundwater quality will be evaluated during the system start-up and optimization in accordance with the start-up and optimization procedures to be specified in the Groundwater Extraction Remedial Action Work Plan.” No other monitoring program has been specified to demonstrate that the groundwater extraction system meets the performance standard established in the Section III.D.4.b of the July 23, 2001 Consent Decree. Consequently, unless such a monitoring and evaluation program is established as part of a preceding report, the Groundwater Extraction RAWP must include a System Start-Up and Optimization Plan.

## **APPENDIX B Groundwater Modeling in Support of Extraction System Design**

9. Appendix B, Section B-4.2, provides a description of, and results from, simplified modeling efforts using FLOWPATH conducted in support of preliminary model design. While these modeling efforts are likely sufficient for the purpose of preliminary model design, the modeling efforts performed to support final design should be presented with more detail and with sufficient rigor to ensure that they provide an adequate basis for the extraction system design. Specifically, they should identify the thickness of the aquifer system assumed. The analysis for the shallow zone extraction wells should include an assessment of the expected drawdown in the extraction well relative to the saturated thickness of the shallow zone. The impact of that drawdown on the computation the expected capture zone should be assessed. The gradients used should be fully documented. The gradient currently used for the analysis of shallow wells appears to be somewhat low based on the 2001 water level data presented in Figure 7 of the Draft RDR/GES. When constructing a model for use in evaluating the final system, care should be taken to ensure that the wells are orientated correctly relative to the groundwater gradients observed. A sensitivity analysis of the key parameters, such as hydraulic conductivity, aquifer thickness, and groundwater gradients, should be presented to demonstrate the capability of the system to achieve hydraulic control based on the range of conditions that might be encountered.